

A New Fern from Western Mexico and its Bearing on the Taxonomy of the Cheilanthoid Ferns

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Throughout the history of pteridology, and in taxonomy in general, it has been stressed that the reproductive parts are conservative and taxonomically most useful. In the ferns the sori have been the focal point of taxonomic scrutiny because they seem to be dependable indicators of relationship, especially at the generic and higher levels. The vegetative parts generally vary much more and are taxonomically less dependable. Linnaeus recognized 15 genera based largely on sorus form. The general form of the sorus was examined more closely as years went on, and it was found that the same general sorus type was often reached in different ways. There was heavy reliance on the sorus until well into the present century. The sorus position was vital to Bower (1923-1928) in his construction of major phyletic lines in the ferns. The recent prevailing philosophy among pteridologists has been to use an assortment of characters, with modern studies extending to finer microscopic detail of morphological features (especially with the SEM) and chemical examination.

Thus, *Acrostichum*, originally encompassing all ferns with sporangia spread across the back of the fertile frond, now contains but three species, with other groups having acrostichoid sori, such as *Elaphoglossum*, *Bolbitis*, *Lomariopsis*, and *Polybotrya*, being recognized as having no close ties with *Acrostichum*. Similarly, species belonging at one time to *Polypodium*, with dorsal, round, exindusiate sori, included species now placed in *Grammitis*, *Thelypteris*, *Cyathea*, *Lophosoria*, *Dryopteris*, and others.

In the *Adiantaceae* (s.l.) there are two basic sorus types. Several genera have the sorus at the end of veins with a distinct, differentiated marginal flap, or false indusium, recurved to protect the sorus. This includes such genera as *Pteris*, *Cheilanthes*, *Pellaea*, *Doryopteris*, *Cryptogramma*, and *Llavea*.

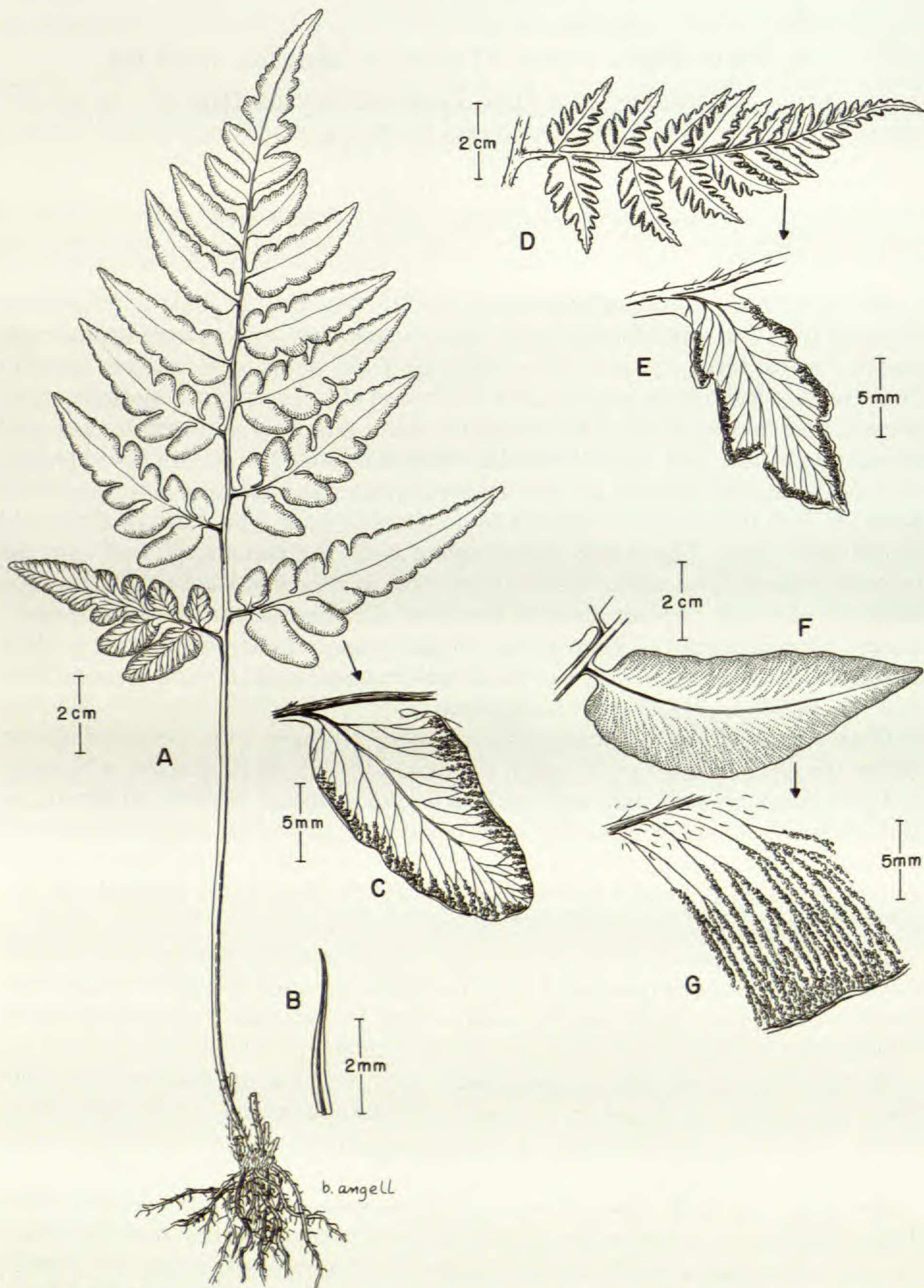
On the other hand, "gymnogrammoid" sori, with the unprotected sporangia along the veins, are found in *Pityrogramma*, *Anogramma*, *Hemionitis*, *Bommeria*, *Antrophyum*, *Hecistopteris*, *Jamesonia*, *Eriosorus*, *Pterozonium*, *Coniogramme*, and others.

During a study of the ferns of western Mexico, the author came across a plant (Figs. A-C) that appeared to be a hybrid between two species that represent these two extremes of sorus configuration: *Hemionitis subcordata* (D. Eaton ex Davenp.) Mickel with gymnogrammoid sori (Figs. F, G) and *Cheilanthes skinneri* (Hook.) Tryon & Tryon with marginal sori (Figs. D, E).

The specimen has characters of the presumed parents (Table 1), both of which were present at the type locality. (*Selaginella pallescens* was the only additional pteridophyte collected there.) Most notably, the plant is intermediate in dissection

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FIGS. A-C. *Cheilanthes gryphus* (McVaugh 15908). A, Habit. B, Rhizome scale. C, Pinnule. D, E. *Cheilanthes skinneri* (Mickel 727, ISC, Guerrero). D, Pinna. E, Pinnule. F, G. *Cheilanthes subcordata* (Mickel 6241, NY, Oaxaca). F, Pinna. G, Close-up of pinna.

TABLE 1. A Comparison of Characters in *Cheilanthes subcordata*, *C. gryphus*, and *C. skinneri*.

Character	<i>C. subcordata</i>	<i>C. gryphus</i>	<i>C. skinneri</i>
Rhizome stout, short-creeping	X	X	X
Rhizome scales bicolorous	X	X	X
Stipe tan, sulcate-winged	X	X	X
Rachis sulcate-winged	X	X	X
Blade dissection	1-pinnate	pinnate-pinnatifid to 2-pinnate	2-4-pinnate-pinnatifid
Pinnae, length of petiole	1-3 mm	4-5(-10) mm	(6-)10-25 mm
Pinnae, number of pairs	1-4(-6)	5-7	8-12
Pinnae shape	lance-ovate, acute	lanceolate, acuminate	lance-deltate, acuminate
Pinnae basiscopically enlarged	—	X	X
Lower blade surface sparsely pubescent	X, pale	X, pale	X, green
Veins	many anastomoses	few anastomoses	free
Proximal portion of lower surface of pinna midvein	black	± black	green
Pinna margin	not modified, narrow, revolute	irregularly modified, medium width and highly modified in places	highly modified, discrete or continuous, revolute, broad
Sori	along distal $\frac{2}{3}$ to all of vein	along distal $\frac{1}{3}$ of vein	at vein tips
Spores	cristate	cristate	cristate
Spore size	31.5 μ m	30.1 μ m	31.3 μ m

(nearly 2-pinnate vs. 1-pinnate and 3-pinnate in the presumed parents), the sori are limited to the distal $\frac{1}{3}$ of the veins (vs. most of the vein length and vein ends), and the veins are casually anastomosing (vs. free and netted). On the other hand, the few spores present are well formed, so it seems to be fertile. Chromosome studies by Michael Windham have shown it to be diploid, $n = 30$ II (Ranker, in litt.). Furthermore, isozyme studies by Ranker (in litt.) show the compounds of the intermediate not to be cumulative of the presumed parents as would be expected of hybrid plants. Thus, although it is found only with its presumed parents and intermediate in several outstanding characters, it is concluded that the plant is a fertile diploid species rather than a hybrid. More work is needed, however, on reproduction in this species group.

The presumed parents of the plant in question are so distinct in their sorus configuration that it had not previously been suspected that they were closely allied. They had been placed by all taxonomists in separate genera and by some even in different families. Pichi Sermolli (1977), for example, placed *Hemionitis*

in the Hemionitidaceae and *Cheilanthes* in the Sinopteridaceae. Holttum (1947) suggested, however, that *Pityrogramma* and *Hemionitis*, although with gymno-grammoid sori, belonged with the cheilanthoid group rather than with the other gymno-grammoids, and Tryon and Tryon (1982) placed *Bommeria* and *Hemionitis* with the cheilanthoid ferns (tribe Cheilantheae), leaving *Pityrogramma* with *Jamesonia* and allies in tribe Taenitideae. On the basis of habitat, range, rhizome scales, and spore morphology, I would concur with this relationship, and the discovery of this plant suggests an even closer relationship than was previously supposed.

Neither of the presumed parents is typical of its genus. *Cheilanthes skinneri* has until recently resided in the genus *Pellaea* s.l. It was recently transferred to *Cheilanthes* (Tryon & Tryon, 1981), although it is not typical of that genus either. *Hemionitis subcordata* has been placed in *Coniogramme* and *Gymnopteris*, the latter in turn later combined with *Hemionitis* (Mickel, 1974), but it is not a typical member of that genus either, differing from most species by the subglabrous blade, crested spores and different chemistry (Mickel, 1974; Giannasi & Mickel, 1979).

Apparently, characters other than sorus position should be used to tie this small group of species together. Characters they have in common include bicolorous rhizome scales, blade indument of hairs blending to narrow scales, and perhaps most significantly segments and pinnae decurrent onto the rachis, making a single sulcus on the stipe. If indeed this is a natural and distinct group (or even genus), other species that may belong here include *Cheilanthes lozanii* (Maxon) Tryon & Tryon, which agrees in rhizome and blade indument but not decurrent segments, and *C. bolborrhiza* Mickel & Beitel, ined., which agrees in its decurrent segments but has concolorous rhizome scales and glabrous lamina.

If *Cheilanthes skinneri* and *Hemionitis subcordata* do belong to the same genus, as some common characters suggest, we do not at this time know what it would be. Because of the drastically different sori, *Cheilanthes skinneri* cannot be a *Hemionitis* and *Hemionitis subcordata* does not fit well in *Cheilanthes*. Circumscription of a distinct new genus to accommodate them both is premature until we know more about the variation of the characters in other cheilanthoid ferns, especially since there seem to be no other species that share the common characters of *C. skinneri* and *H. subcordata*.

Because of the evidence against the plant representing an intergeneric hybrid between *Cheilanthes* and *Hemionitis*, I am treating this small group within *Cheilanthes*, recognizing that it may eventually deserve generic rank. This requires a transfer of *Hemionitis subcordata* (D. Eaton ex Davenp.) Mickel:

9932 ***Cheilanthes subcordata*** (D. Eaton ex Davenp.) Mickel, comb. nov.—*Gymno-*
9931 *gramma subcordata* D. Eaton ex Davenp. in Rose, Contr. U.S. Natl. Herb. 5:
138, t. 16. 1897.

9933 ***Cheilanthes gryphus*** Mickel, sp. nov. (Figs. A–C). ✓ TYPE: Mexico, Colima, low
mountain summits 7 mi N of Santiago, road to Durazno, Jalisco, via the bridge
over Río Cihuatlán, deciduous woodlands, 200 ft, 30 Jul 1957, McVaugh 15908
(MICH).

Inter *Cheilanthem skinneri* et *C. subcordatam* notulis nonnullis intermedia.

Rhizoma horizontale compactum; paleae lineares bicolores; lamina pinnato-pinnatifida; pinnae 5-7 jugae obtuse 2-4-lobae; nervi hinc inde anastomosantes; sporangia secus venas distaliter per 2-4 mm seriatim disposita; sporae tetrahedro-globosae cristatae.

The specific epithet derives from L., *gryphus*, griffin, a hybrid between a lion and an eagle, hence an archetype of the union of incompatibles.

Rhizome horizontal, compact, 3-7 mm diam.; rhizome scales 2-3 mm long, linear, extremely slender, bicolorous, with a central, lustrous, dark castaneous to atropurpureus streak and narrow, tan margin; fronds to 46 cm tall, approximate; stipe stramineous, grayish-brown at base, with very slender, mostly bicolorous scales at base, otherwise glabrous, deeply 3-grooved, about equalling the blade in length; blade broadly lanceolate or moderately deltate, pinnate-pinnatifid to nearly bipinnate at base; pinnae 5-7 pairs, each lanceolate to deltate, acuminate, with 2-4 pairs of broad obtuse lobes, the basiscopic lobes ca. twice as long as the acroscopic ones; upper surface glabrous, lower surface with sparse straight hairs, which grade into very sparse, narrow, bicolorous scales on the rachis and pinna rachises; veins mostly free but with occasional anastomoses (2-5/pinna); sporangia running along the terminal 2-4 mm of the veins, indusium lacking, blade margin not reflexed nor modified; spores tetrahedral, crested.

Paratype: Mexico, Nayarit, S of Tepic along Hwy 200 near km post 24 between Colonias and El Refilón, mixed deciduous forest in moist, shaded gully, 8 Jul 1985, Ranker 799 (KANU).

Several other fern genera or generic groups include taxa with highly disparate soral dispositions. *Tectaria*, with round, dorsal sori, is closely allied to *Cionidium*, which has extramarginal sori. *Polypodium*, with round, dorsal sori, is close to *Dicranoglossum* and *Neurodium* with linear, submarginal sori. *Polystichum*, with round, dorsal, indusiate sori, has a splinter *Plecosorus*, in which the indusium is lost but the sorus is protected by a differentiated margin (false indusium) as in *Cheilanthes*. *Asplenium* has elongate, dorsal sori, whereas *Diellia* and *Loxoscapha* have sori in subterminal cups. Perhaps the most dramatic example of diverse sorus types is seen in *Tectaria* and its close relative *Dictyoxiphium*, which has linear, marginal sori, and the intergeneric cross, \times *Pleuroderris michleriana*, as described in detail by Wagner et al. (1978).

Within the Adiantaceae itself there are some transitional states between marginal and gymnogrammoid sori, although they are not as dramatic as that found in *Cheilanthes gryphus* and allies. In *Adiantum* the sori, although protected by the marginal flap, are located along veins under the false indusium. In the marginal sori of *Pellaea* the sori are, in fact, somewhat elongate along the veins, sometimes a millimeter or two, and in one species, *P. bridgesii*, the sori are medial along the veins for 1-2 mm (Wagner et al., 1983). Haufler (1979) has pointed out the extreme variation of sorus length in *Bommeria*.

The case of *Cheilanthes gryphus* suggests that in this complex, at least, sorus pattern is of little taxonomic significance. We need to find new sets of characters for the generic segregation in the whole family, e.g., rhizome scales, blade indument, axis grooving, gametophyte morphology, breeding systems, and chemistry. All characters must be examined critically without heavy reliance on traditional characters.

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